REMARKS

Claims 8-10, 14-22, and 31-41 are pending in this application. Claims 1-7, 11-13, and 23-30 have been canceled. The invention of claims 8-10, 14-22, and 31-41 is discussed below with reference to the Office Action mailed March 27, 2007.

Claims 8-10, 14-16, 20-21, 31-35, and 39-41 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okumura (JP 06-299312). Claims 8-10, 14-22, and 31-41 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okumura (JP 06-299312) in view of Applicant's disclosure of the prior art.

Remarks Directed to the Rejection of Claims 8-10, 14-16, 20-21, 31-35, and 39-41 Under 35 U.S.C. § 103(a) as Being Unpatentable over Okumura (JP 06-299312):

Withdrawal of the rejection of claims 8-10, 14-16, 20-21, 31-35, and 39-41 under 35 U.S.C. § 103(a) as being unpatentable over Okumura (JP 06-299312) ("Okumura") is requested for at least the following reasons. Okumura does not provide the motivation to make steel with an intermetallic layer between 1 and 5 microns per pending independent claims 8 and 31and specifically teaches away from success with intermetallic thicknesses greater than 1 micron. Applicant can rebut a presumption of obviousness based on a claimed invention that falls within a prior art range by showing "(1) [t]hat the prior art taught away from the claimed invention...or (2) that there are new and unexpected results relative to the prior art." *Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1322, 73 USPQ2d 1225, 1228 (Fed. Cir. 2004).

Both showings are present in the instant application. Okumura both teaches away from the claimed steel with an intermetallic layer greater than 1 micron, and the layering of an iron-aluminum intermetallic alloy layer between 1 and 5 microns unexpectedly promotes increased corrosion resistance with no stated loss in workability.

Unexpected Results:

Okumura is cited as teaching an iron-aluminide intermetallic alloy layer with a thickness of about 1 micron or less. (Paper No. 20070325, p. 3.) However, Okumura does not teach an intermetallic layer of about 1 micron or less, it teaches an intermetallic layer at one micron or less. ("it becomes impossible to carry out 1 micrometer of the thickness." [0012]; "according to this invention, it is necessary to set to 1 micrometer or less thickness of the intermetallic-compound layer." [0009]; "base materials from Fe-aluminum with a thickness of 1 micrometer or less." [0007]) Thus, Okumura does not teach a range of about 1 micron, but at one micron and specifically places an upper limit on the range of iron-aluminum thickness at 1 micron. Okumura reasons that the greatest thickness of the iron-aluminum layer is 1 micron because steel manufactured with an intermetallic layer is "also hard, it is weak and a processing student will deteriorate if the thickness exceeds 1 micrometer." [0009] Further, when the "growth of a Fe-aluminum intermetallic-compound layer becomes excessive, it becomes impossible to carry out 1 micrometer of the thickness, and both the workability of plating steel materials is degraded remarkably in this way." [0012] (emphasis added)

The thickness of the claimed intermetallic layer of claims 8 and 31is "greater than 1 micron and less than 5 microns" and is essential to its function as an anti-corrosive that has an extended serviceable lifetime. Applicants can rebut a *prima facie* case of obviousness based on overlapping ranges by showing the criticality of the claimed range. MPEP 2144.05. The criticality of an intermetallic layer thickness between 1 and 5 microns is evidenced by the prior art disclosed in the specification.

> There have been countless prior art coating and processes intended to protect steel from electrochemical oxidation. Unfortunately, all of these methods have invariably been effective for a period of

> time less than the useful life of the steel-containing article thereby resulting in the need for regular maintenance checks, reapplication of coatings, and often the replacement of the steel article.

(paragraph bridging pgs 1 and 2.) Further, "in complex piping or engineering structures, evaluation, recoating and replacing steel regularly exceeds the initial construction cost over the lifetime." *Id.* Thus, the prior art steel, even that with an intermetallic layer at 1 micron, is insufficient in the art of steel construction. An intermetallic layer between 1 and 5 microns is critical to the instant invention. This additional thickness provides corrosion resistance unattainable by the prior art where "an intermetallic surface alloy of sufficient thickness . . . remains a challenge. (p. 3, lines 17-18.) Thus, the range between 1 and 5 microns, as in the instant invention, is critical to its success overcoming the *prima facie* case of obviousness.

The instant invention, further provides unexpected results by overcoming "the ductility and strength of such intermetallic alloys relative to an underlying steel substrate [and] fabrication issues" of the prior art. (p. 3, lines 19-20.) For example, Okumura teaches that "the workability of plating steel materials is degraded remarkably" by an intermetallic layer greater then 1 micron. [0012] (emphasis added). Further, Sippola (US Patent 4,971,842) teaches that when forming an intermetallic layer of iron-zinc when coating steel with zinc "[i]n order to achieve good formability of the zinc coating, the intermetallic layer should be as thin as possible. (col. 1, lines 42-44.) Thus, both Okumura and the prior knowledge in the art recognized that an intermetallic layer greater than 1 micron reduced the workability of the steel. In contrast, this failing of the prior art steel is unexpectedly not found in the instant invention. In this way, the instant invention provides steel that is capable of "extend[ing] the serviceable lifetime of steel systems exposed to gaseous oxidants." (p. 5, lines 8-9.)

> The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.

In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). The unexpected increase in corrosion resistance combined with a lack of decrease in ductility and strength of the instant intermetallic layer are examples of the unexpected results relative to the prior art range.

Therefore, the instant specification and invention provides a range of 1 to 5 microns that is critical to generation of the increased corrosion resistance of the inventive steel product. As such, the instant invention is nonobvious over Okumura.

Unique Species:

The pending claims recite a range of iron-aluminum intermetallic alloy with a thickness "greater than 1 micron and less than 5 microns". This claimed range represents a subgenus of that is illustrated but not claimed by Okumura. If the reference's disclosed range is so broad as to encompass a very large number of possible distinct compositions, this might present a situation analogous to the obviousness of a species when the prior art broadly discloses a genus. *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003); *See also In re Baird*, 16 F.3d 380, 29 USPQ2d 1550 (Fed. Cir. 1994); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); MPEP § 2144.08. Okumura illustrates a genus of iron-aluminum intermetallic alloys with thicknesses between 0.2 and 5 microns. However, the genus of Okumura encompasses numerous distinct compositions having unique properties. For example, steel of Okumura with an iron-aluminum intermetallic layer less than one micron possesses excellent resistance to processing section crack initiation. [Table 2] However, the physical and

chemical characteristics of Okumura steel change when the intermetallic layer is greater than 1 micron as the layer is both hard and weak such that the layer is now readily susceptible to processing section crack initiation. [Table 2] Thus, numerous species are taught by Okumura.

It is the properties and utilities that provide real world motivation for a person of ordinary skill to make species structurally similar to those in the prior art. *In re Dillon*, 919 F.2d 688, 697, (Fed. Cir. 1990) (en banc); *In re Stemniski*, 444 F.2d 581, 586, 170 USPQ 343, 348 (CCPA 1971). Conversely, lack of any known useful properties weighs against a finding of motivation to make or select a species or subgenus. *In re Albrecht*, 514 F.2d 1389, 1392, 1395-96, 185 USPQ 585, 587, 590 (CCPA 1975). The lack of known workability of the steel of Okumura with a thickness greater than 1 micron weighs against finding motivation to make or select steel with an iron-aluminum intermetallic alloy layer greater than 1 micron and less than 5 microns thick as being currently claimed. Okumura provides no real world motivation to make steel with an intermetallic layer greater than 1 micron. For example, Okumura reasons that the greatest thickness of the iron-aluminum layer is 1 micron because steel manufactured with an intermetallic layer is "also hard, it is weak and a processing student will deteriorate if the thickness exceeds 1 micrometer." [0009] Further, when the "growth of a Fe-aluminum intermetallic-compound layer becomes excessive, it becomes impossible to carry out 1 micrometer of the thickness, and both the workability of plating steel materials is degraded remarkably in this way." [0012] (emphasis added) The real world properties of the subgenus taught by Okumura between 1 and 5 microns are the reduction in workability of the substance in the prior art that is not found to be an issue with the instant invention. Okumura teaches that steel with an intermetallic alloy layer greater than 1 micron has reduced workability characteristics decreasing the usability of the invention and the overall corrosion resistance. This

problem is not found in the instant invention, and corrosion resistance is improved. Thus, Okumura provides no real world motivation for a person having ordinary skill in the art to produce steel with an intermetallic layer greater than 1 micron. As such, the teaching of Okumura weighs against a finding of obviousness.

Instant Invention Contrary to Art Accepted Wisdom:

The prior art taken as a whole teaches that an intermetallic layer should not exceed a thickness of 1 micron. The totality of the prior art must be considered, and proceeding contrary to accepted wisdom in the art is evidence of nonobviousness. *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986) (Applicant's claimed process for sulfonating diphenyl sulfone at a temperature above 127°C was contrary to accepted wisdom because the prior art as a whole suggested using lower temperatures for optimum results as evidenced by charring, decomposition, or reduced yields at higher temperatures.) Similarly, the prior art in creating intermetallic layers on steel for corrosion resistance teaches that the thickness of the intermetallic layer should be as thin as possible. For example, Sippola (US Patent 4,971,842) teaches that when forming an intermetallic layer of iron-zinc when coating steel with zinc "[i]n order to achieve good formability of the zinc coating, the intermetallic layer should be as thin as possible." Further, Okumura teaches that "the workability of plating steel materials is degraded remarkably" by an intermetallic layer greater then 1 micron. [0012] (emphasis added). Thus, both Okumura and the prior knowledge in the art recognized that an intermetallic layer greater than 1 micron made the steel unworkable. As such, the use of an intermetallic layer between 1 and 5 microns in thickness is contrary to the accepted wisdom in the prior art dictates that the instant invention is nonobvious.

Furthermore, "[k]nown disadvantages in old devices which would naturally discourage search for new inventions may be taken into account in determining obviousness." *United States v. Adams*, 383 U.S. 39, 52, 148 USPQ 479, 484 (1966). Okumura teaches that "according to this invention, it is necessary to set to 1 micrometer or less thickness of the intermetallic-compound layer." [0009] Okumura reasons that the greatest thickness of the iron-aluminum layer is 1 micron because steel manufactured with an intermetallic layer is "also hard, it is weak and a processing student will deteriorate if the thickness exceeds 1 micrometer." [0009] Finally, when the "growth of a Fe-aluminum intermetallic-compound layer becomes excessive, it becomes impossible to carry out 1 micrometer of the thickness, and both the workability of plating steel materials is degraded remarkably in this way." [0012] (emphasis added) Thus, the known disadvantages of increased processing section crack initiation [Table 2] when the intermetallic layer is greater than 1 micron naturally discourage the search for new inventions with an intermetallic layer greater than 1 micron. This provides further evidence of nonobviousness of the instant invention.

Evidence of Secondary Considerations:

The Supreme Court in *Graham v. John Deere*, 383 U.S. 1, 148 USPQ 459 (1966), stated: that "[s]uch secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquires may have relevancy." Further, it is policy of the USPTO to analyze:

> [o]bjective evidence or secondary considerations such as unexpected results, commercial success, long-felt need, failure of others, copying by others, licensing, and skepticism of experts are relevant to the issue of obviousness and must be considered in every case in which they are present.

Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 USPQ 81 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987); MPEP 2141. Arguments directed to unexpected results are stated above and are incorporated herein by reference.

Further, the instant specification provides clear evidence of a long-felt need for an improved corrosion resistant steel such as that provided by the instant invention as the prior art steel was inadequate. "The reaction of a steel surface to form an intermetallic surface alloy of sufficient thickness to provide corrosion resistance remains a challenge. Furthermore, the ductility and strength of such intermetallic alloys relative to an underlying steel substrate often creates fabrication issues." (p. 3, lines 17-20.) "There exists a need for a more corrosion-resistant coating composition for steel . . . ." (p. 5, lines 9-10.)

The prior art of Okumura also teaches that steel with an intermetallic layer thickness greater than 1 micron is insufficient in that it shows increased processing section crack initiation. [0024; Table 2] Okumura reasons that the greatest thickness of the iron-aluminum layer is 1 micron because steel manufactured with an intermetallic layer is "also hard, it is weak and a processing student will deteriorate if the thickness exceeds 1 micrometer." [0009] Finally, when the "growth of a Fe-aluminum intermetallic-compound layer becomes excessive, it becomes impossible to carry out 1 micrometer of the thickness, and both the workability of plating steel materials is degraded remarkably in this way." [0012] (emphasis added)

Thus, the prior art and the instant specification taken as a whole highlights a long-felt need for improved corrosion resistant and workable steel such as is provided by the instant invention. Similarly, the prior work by Okumura is evidence of both failure of others and skepticism of experts in the usefulness of steel with an iron-aluminum intermetallic layer greater

than 1 micron in thickness. As evidenced by the statements in Okumura cited above, the expert (Okumura) clearly identifies skepticism as to the usefulness of steel with an intermetallic layer greater than one micron due to an increase in processing section crack initiation. [0024; Table2.]

In light of the above remarks, independent claims 9 and 31 are believed to be nonobvious over Okumura and drawn to patentable subject matter. As claims 9-10, 14-16, and 20-21 depend from claim 9, and claims 32-35, and 39-41 depend from claim 31 each incorporating all limitations from the claim from which they depend, claims 9-10, 14-16, 20-21, 32-35, and 39-41 are also believed to be nonobvious and directed to patentable subject matter.

In addition, regarding claims 9-10, 14-16, and 20-21, claim 9 is currently amended to recite an "iron-aluminum intermetallic comprises at or between 18% and 56% aluminum by weight." This amendment is fully supported by the instant specification as originally filed *inter alia* p. 9, lines 9-14. As such, Okumura does not teach or suggest all the claimed limitations either expressly or inherently. "To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Okumura does not teach or suggest corrosion resistant steel comprising a mild steel with an adjacent iron-aluminum intermetallic layer having a thickness of greater than 1 micron and less than 5 microns wherein the iron-aluminum intermetallic comprises at or between 18% and 56% aluminum by weight. Any illustration of an iron-aluminum intermetallic layer in Okumura is either less than or equal to 0.5 microns in thickness (see Table 2, illustrations 1-17, 1, and 4-6) or are above 56% aluminum. (see table 2, illustrations 2-3 and 7-9.) Further, the text of Okumura does not teach or suggest an iron-aluminum layer with a thickness between 1 and 5 microns and aluminum content at or between 18% and 56%.

Further regarding claims 32-35 and 39-41, claim 32 is currently amended to recite an "iron-aluminum intermetallic comprises at or between 18% and 56% aluminum by weight." This amendment is fully supported by the instant specification as originally filed inter alia p. 9, lines 9-14. As such, Okumura does not teach or suggest all the claimed limitations either expressly or inherently as illustrated by the above text and table 2 of Okumura.

All limitations of claims 9 and 32 are neither taught nor suggested by Okumura, and claims 9 and 32 are believed to be directed to patentable subject matter based on independent grounds. As claims 10, 14-16, and 20-21 each depend from claim 9 and incorporate all limitations from claim 9, claims 10, 14-16, and 20-21 are also believed to be directed to patentable subject matter. Further, as claims 33 and 39-41 each depend from claim 32 and incorporate all limitations from claim 32, claims 33 and 39-41 are also believed to be directed to patentable subject matter.

In light of the above remarks that the teaching of Okumura, and the prior art taken as a whole, provides clear evidence of the nonobviousness of the instant invention as claimed, withdrawal of the rejection of claims 8-10, 14-16, 20-21, 31-35, and 39-41 under 35 U.S.C. § 103(a) is respectfully requested.

Remarks Directed to the Rejection of Claims 8-10, 14-22, and 31-41 under 35 U.S.C. § 103(a) as Being Unpatentable over Okumura in View of Applicant's Disclosure of the Prior Art

The above remarks regarding Okumura are herein incorporated by reference. Given these remarks, withdrawal of the rejection of claims 8-10, 14-22, and 31-41 under 35 U.S.C. § 103(a) as being unpatentable over Okumura in view of Applicant's disclosure of the prior art is requested.

Summary

Claims 8-10, 14-22 and 31-41 are submitted for consideration. Each claim is believed to be in allowable form and directed to patentable subject matter. Reconsideration and withdrawal of the outstanding rejections and the passing of this application to issuance are solicited. Should the Examiner find to the contrary, he is respectfully requested to contact the undersigned attorney in charge of this application to resolve any remaining issues.

Respectfully submitted,

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Date: 6/27/07